DOCUMENT RESUME

ED 295 632 IR 013 342

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TITLE The Effects of Feedback, Correctness of Response, and Response Confidence on Learner's Retention in Computer-Assisted Instruction.
PUB DATE Jan 88
NOTE 14p.; In: Proceedings of Selected Research Papers presented at the Annual Meeting of the Association for Educational Communications and Technology (New Orleans, LA, January 14-19, 1988). For the complete proceedings, see IR 013 331.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Students; Comparative Analysis; *Computer Assisted Instruction; *Confidence Testing; *Feedback; Higher Education; Intermode Differences; Pretests Posttests; *Programed Instruction; Psychological Studies; *Retention (Psychology); *Student Reaction

ABSTRACT

This study examined the effects of feedback, the correctness of response, and response confidence within the context of computer-assisted instruction (CAI). The subjects were 120 students enrolled in the four computer literacy classes at the University of Texas. The instructional material on the human eye involved 30 program frames with three alternative multiple choice questions relating to the content of the lesson; the type of instructional task was recall of verbal information. One group was provided with feedback response in addition to choosing a confidence level for their answers; the other group was given only a choice of confidence level. Both groups were given immediate and delayed posttests. When the means on the immediate posttests were compared, those who received feedback performed significantly better than those who had not. However, the delayed posttest results showed no significant difference between the feedback and no feedback groups. It was also found that when the learner's confidence in the response was taken into account, providing feedback on either a high confidence or a low confidence correct response did not increase the probability that the response would be made correctly on later tests, although feedback on either a high confidence or low confidence incorrect answer helped the learner to correct the error. The text is supplemented by one figure and three tables. (24 references) (EW)

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The Effects of Feedback, Correctness of Response, and Response Confidence on Learner's Retention in Computer-Assisted Instruction

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IR013342

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THE EFFECTS OF FEEDBACK, CORRECTNESS OF RESPONSE, AND RESPONSE CONFIDENCE ON LEARNER'S RETENTION IN COMPUTER-ASSISTED INSTRUCTION

The role of microcomputer technology in the educational process is of an increasing interest among educators. In educational computing, computer-assisted instruction (CAI) is seen by many educational leaders as a cost-efficient and effective method of instruction (Nelson, 1985-86). Clark (1983) states that the novelty of CAI motivates student's learning. The novelty effect, however, usually wears off after a few weeks. Waldrop (1984) suggests that instructional designers cannot rely solely on the computer as a prime source of reinforcement. Rather, the source of reinforcement should come from the content and structure of CAI through the systematic application of sound principles of learning.

One important element in the design of computer-assisted instruction is feedback. The ability to give appropriate and timely feedback has often been cited as an advantage of CAI (Magidson, 1977; Dence, 1980). Because of the increasing demand for quality CAI, there is a need to investigate the effects of feedback within the context of CAI (Carter, 1984).

Although it has been widely accepted among educators that feedback facilitates learning in many teaching situations, no decisive agreement has been made regarding how feedback acts to promote learning and retention. According to operant psychologists, feedback following a correct response reinforces and thus increases the probability that the response will be made again in the future (Bigge, 1982). However, research has indicated that feedback operates primarily to correct errors rather to reinforce correct response as claimed by operant psychologists (Guthrie, 1971; Anderson, Kulhavy, & Andre, 1972; Roper, 1977, Bardwell, 1981).

Most of the studies in the area of instructional feedback have been conducted to investigate the effects of different types of feedback on learning. Few attempts, however, have been made to consider the effects of adapting the feedback strategy to match a learner's specific needs at the moment of learning. Traditionally, feedback is provided to the learner based on the correctness of his response; and the same type of feedback is given to the learner throughout the lesson regardless of his response. Some educators suggest, however, that in self-instructional material, feedback that is provided to the learner should be "specific" to the performance being made (Smith & Smith, 1966; Caldwell, 1980).

Feedback research has suggested that the learner's response confidence affects the way in which he uses feedback information (Kulhavy, Yekovich & Dyer, 1976; 1979). Kulhavy, et al. (1976) conducted a study to investigate the relationship between feedback, confidence, and postresponse behavior. It was found that feedback study times were shortest for correct responses with high confidence, longest for incorrect responses with high confidence, and somewhere in between for responses with low confidence. Responses with high confidence were remembered more accurately on the tests regardless of the correctness of the responses. No major differences were found between the two groups regarding responses with low confidence. From the results of the study, Kulhavy (1977) suggested that the interaction between feedback and learner expectation in terms of his or her response confidence could provide a powerful effect on learner's retention. He also suggested that the learner's confidence in the response might be used as a basis for an effective design strategy for providing feedback, especially when the instruction was under the control of computer.

Based on the results of the study conducted by Kulhavy, et al. (1976), knowledge of learner's response confidence and correctness of response may be used in identifying the type of feedback which will be appropriate to the learner's postresponse behavior. The model in figure 1 represents a hypothetical framework for presenting feedback in CAI lesson. There are four possible conditions for each response.

1) Correct Response with High Confidence

For this condition, only the knowledge of results (KOR) feedback ("Correct") will be needed for providing confirmation of the correct answer. Additional information is not necessary since the learner answered correctly and had confidence in the answer.

2) Correct Response with Low Confidence

Under this condition, telling the learner that his or her response was correct may not be sufficient. Additional information in the feedback message would seem to be needed to increase the level of confidence. Consequently, the knowledge of results and positive response-contingent feedback (a statement of why the response is correct) would be given to the learner.

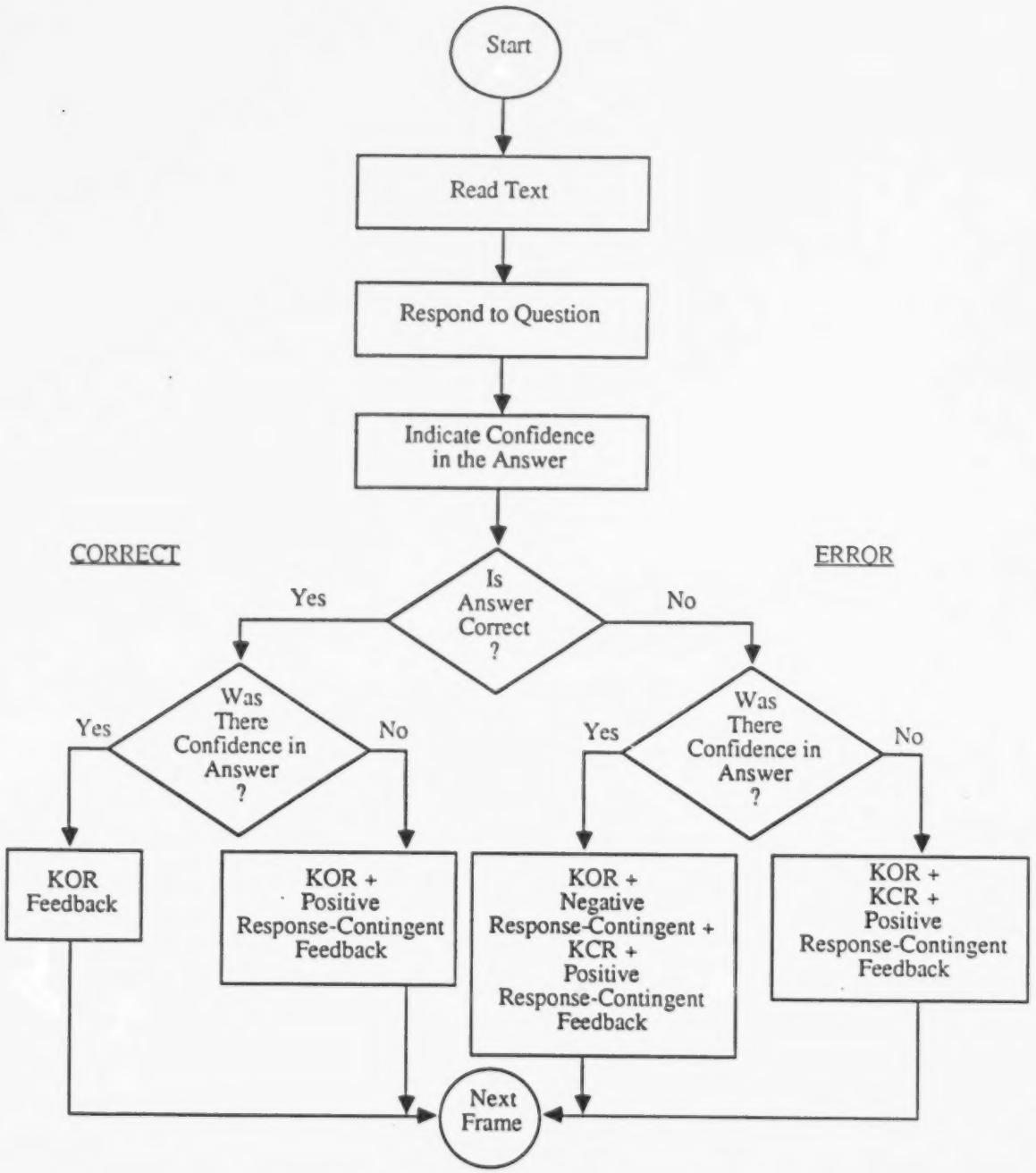

Figure 1

Hypothetical Design Model for Providing Feedback in a CAI lesson

3) Incorrect Response with High Confidence

For this condition, additional feedback information will be necessary to correct error response. As suggested by Echternacht, Boldt and Sellman (1971), the learner should first be shown why the alternative selected was incorrect; and, after he or she is convinced of the error, be shown why the keyed answer is, in fact, correct. Consequently, for this condition, the learner will be given knowledge of the results, plus negative response contingent feedback (a statement of why the response is incorrect), plus knowledge of the correct response (feedback of correct choice), plus positive response-contingent feedback (a statement of why the keyed answer is correct).

4) Incorrect Response with Low Confidence

For this condition, the learner should be shown why the correct answer is correct (Echternacht, Boldt, & Sellman; 1971). Thus the learner will be given knowledge of results ("incorrect"), plus knowledge of correct response (feedback of correct choice), plus positive response-contingent feedback (a statement of why the keyed answer is correct).

Purpose of the Study

The purpose of this study is to examine within the context of CAI, the effects of feedback, correctness of response, and response confidence on learner's retention of verbal information. The model in Figure 1 was used as a design strategy for providing feedback in this study.

Specifically, the questions investigated in this study are:

1. Does feedback which is based both on the correctness of response and learner's confidence help to promote student's retention of learned material?
2. Does feedback following a correct response serve to ensure that a correct response will be made on a later test?
3. Does feedback following an incorrect response serve to correct the mistake and ensure that a correct response will be made on a later test?
4. Do different levels of confidence interact with feedback following a correct response which may serve to ensure that a correct response will be made on a later test?
5. Do different levels of confidence interact with feedback following an incorrect response which may serve to correct mistake and ensure that a correct response will be made on a later test?

It was expected on both immediate and delayed posttests that the feedback group would perform significantly better than the no feedback group with respect to the following dependent variables:

1. overall correct responses
2. conditional probability of a correct response on a test given that a correct response was made on the lesson -- $P(R_t|R_l)$
3. conditional probability of a correct response on a test given that an incorrect response was made on the lesson -- $P(R_t|W_l)$
4. conditional probability of a correct response on a test given that a high-confidence correct response was made on the lesson -- $P(R_t|RH_l)$
5. conditional probability of a correct response on a test given that a low-confidence correct response was made on the lesson -- $P(R_t|RL_l)$
6. conditional probability of a correct response on a test given that a high-confidence incorrect response was made on the lesson -- $P(R_t|WH_l)$
7. conditional probability of a correct response on a test given that a low-confidence incorrect response was made on the lesson -- $P(R_t|WL_l)$

Method

Subjects

One hundred and twenty-three students enrolled in four Computer Literacy classes at the University of Texas volunteered to serve as subjects for the study. Due to some errors in recording data onto the diskettes, only one hundred and twenty subjects successfully completed the experiment. The majority of the subjects were upper division education students.

Materials

The instructional material for this study was "The Structure and Function of the Human Eye" published in the book entitled "Programmed Instruction: Techniques and Trends (O'Day, Kulhavy, Anderson & Malczynski; 1971). This experimental material was also used in the study conducted by Kulhavy, et al. (1976). There are thirty program frames with three alternative multiple-choice questions relating to the content of the lesson. Additionally, there are six text-related drawings for use at designated points within the lesson. The type of instructional task was the recall of verbal information.

Feedback Messages. Since different types of feedback message were to be provided to subjects, based upon the correctness of response and response confidence, the feedback messages for each alternative on each question were written by the researcher. These feedback messages were evaluated and criticized by two doctoral students in the department of Science Education at the University of Texas at Austin.

A sample frame and question in the program published in the book entitled "Programmed Instruction: Techniques and Trends (O'Day, Kulhavy, Anderson & Malczynski; 1971) are as follows:

> The rods adapt to dimmer light conditions by means of a visual pigment they contain. . . called rhodopsin. Rhodopsin is often called visual purple because of its characteristic dark blue color. The raw material from which rhodopsin is made is vitamin A, and, thus, a deficiency of vitamin A will result in poor dim-light vision.
>
> Which of the following statements regarding rhodopsin is true?
> (1) It contains a pigment called visual purple.
> (2) It becomes deficient in the presence of vitamin A.
> (3) It is dark blue in color. (p. 163)

The following is an example of feedback message for the instructional frame presented above.

Selected Answer	Level of Confidence	Feedback Message
1	High	Incorrect. Rhodopsin does not contain visual purple. Rhodopsin is often called visual purple. The correct answer is "3". Rhodopsin is often called visual purple because of its characteristic dark blue color.
1	Low	Incorrect. The correct answer is "3". Rhodopsin is often called visual purple because of its characteristic dark blue color.
2	High	Incorrect. Rhodopsin is made from vitamin A. Rhodopsin becomes deficient in the absence of vitamin A. The correct answer is "3". Rhodopsin is often called visual purple because of its characteristic dark blue color.
2	Low	Incorrect. The correct answer is "3". Rhodopsin is often called visual purple because of its characteristic dark blue color.
3	High	Correct.
3	Low	Correct. Rhodopsin is often called visual purple because of its characteristic dark blue color.

Lesson Development. The programming language used in the development of the CAI lesson for this study was SuperPILOT authoring language. Two computer programs were developed in order to present the material. One program was for the no feedback condition, the other was for the feedback condition. For each frame of instruction on the lesson for the no feedback condition, the computer displayed the text screen, recorded the time the subject spent on reading text, displayed the question screen, recorded the response and the response time, and recorded the confidence in the response. Additionally, the program for the feedback condition displayed the feedback message based on the correctness of the response and the subject's response confidence. It also recorded the time that a subject spent on studying the feedback message for each frame. All data for each subject were stored in the data file on the diskette. Time was recorded in numbers of seconds. Since it took a few seconds for the computer to complete filling all the text onto the screen, and since the timer started after the last line of text displayed, the times measured were approximations and should be used as relative rather than absolute measures.

Assessment Instruments. Both immediate and delayed retention measures consisted of the same thirty questions seen in the CAI lesson. However, on both tests the sequence of these questions was randomized. Posttests were paper-and-pencil type tests. On these retention tests, subjects were not asked for response confidence.

Procedures

The experiment was conducted during a regularly scheduled class period in a computer classroom equipped with 41 Apple II computers. All students in a given class were randomly assigned to either the no feedback or the feedback condition. At the beginning of the class, the request for volunteers was made by the class instructor. All students were informed that their regular class grade would not be affected by their performance on the experiment. They were also told that they were not required to participate in the study. However, they would have had to do an alternative assignment during the class had they chosen not to participate. All students attending the class on the days of the experiment volunteered to be part of the study.

Each subject was given the six drawings to be used with the CAI lesson. At the beginning of the lesson, they were asked to type their names. Then they were informed of what they could expect from the lesson. They were initially told that there were thirty frames of instruction in the lesson. Each frame consisted of one screen of text and one screen of question relating to the content of the text. They were instructed to press the "Return" key when they finished reading the text screen. They would then see a screen displaying a multiple-choice question and were asked to enter their response to that question by pressing a number of their choice from 1 to 3. The computer would, at this point, ask them to enter their confidence in the choice they just made. They were instructed to enter "1" which represented "low confidence" if they were not quite sure that their answer was a correct one. If they felt positive that their answer was correct, they were instructed to enter a "2" which represented "high confidence". For the subjects in the no feedback condition, they were told that after they entered the number signifying their degree of confidence in the answer, they would receive a new frame of instruction. Subjects in the feedback group were also told that they would be given a message regarding their answer to question asked, and that they had to press the "Return" key after they finished reading the message.

Upon the completion of the CAI lesson, the diskette and the six drawings were collected by the researcher, and the immediate posttest was administered. One week after the experimental session, the delayed posttest was given to the subjects during the regularly scheduled class period. Since seventeen subjects did not attend the classes on the days of the delayed posttest administration, only one hundred and three subjects took the delayed test. As noted by Borg and Gall (1983), sampling bias may be expected in studies reporting large losses of subjects, for the subjects who remain with the study until its completion may be different from those who drop out. For both those who did and did not take the delayed posttest, analysis of variance was performed on the items answered correctly within the CAI lesson. This was performed to determine whether this study was subjected to sampling bias. The result indicated that there was no significant difference between the subjects who took the test and those who did not ($F = 2.1429$, $p = .1459$).

With respect to procedures, the differences between the study conducted by Kulhavy et al. (1976) and this study are as follows:

1) Form of Instruction

In the study by Kulhavy et al. (1976), the instruction was in the form of programmed instruction. The text and its question were on the same page. The subjects could refer back to the text while they were

answering the question. In this study, the instruction was in the form of computer-assisted instruction. The text and its question were on separate screens. After the subjects turned to the question screen, they could not go back to the previous text screen.

2) Feedback Procedure

In the study by Kulhavy et al. (1976), the subjects in the feedback condition received Knowledge of Correct Response (KCR) feedback by erasing opaque circles on the response card until they located the correct choice for the particular question. In this study, the subjects in the feedback condition received different feedback messages based upon the correctness of their response and their confidence in the response.

3) Rating of Confidence

The subjects in the study by Kulhavy et al. (1976) rated their confidence on a scale of five, whereas the subjects in this study recorded their confidence on a scale of two (high or low).

Design

The design of this study was a posttest only control group design. The design was represented by the following diagram:

$$\begin{array}{llllll} R & O_1 & X & O_2 & O_3 \\ R & O_1 & & O_2 & O_3 \end{array}$$

where

- R = random assignment
- X = experimental treatment (feedback)
- O_1 = practice items on the lesson
- O_2 = immediate posttest
- O_3 = delayed posttest

Data Analysis

All statistical analyses were performed by using SPSS^X (1986) on an IBM 3081 computer at the University of Texas at Austin.

Analysis of Overall Correct Responses. In order to determine the effects of feedback which was provided on the basis of correctness of response and response confidence, one-way analysis of variance was performed on the overall correct responses for the feedback and no feedback groups on each posttest.

Analysis of Conditional Probabilities. Following the procedure used by Kulhavy et al. (1976), conditional probabilities relating lesson performance to the immediate and delayed posttests were calculated to determine the effects that feedback following a correct response had on both posttests. The conditional probability of a correct response on the test given that a correct response was made on the lesson, $P(R_t|R_l)$, is the proportion consisting of the number of responses which were correct on the test and were also correct on the lesson ($R_t \cap R_l$), divided by the total number of responses which were correct on the lesson (R_l). This conditional probability was also calculated for high and low confidence correct responses on the lesson.

To determine the effects that feedback following an incorrect response had on immediate and delayed retentions, conditional probabilities relating lesson performance to the two posttests were calculated. The conditional probability of a correct response on the test given that an incorrect response was made on the lesson, $P(R_t|W_l)$, is the proportion consisting of the number of responses which were correct on the test and were incorrect on the lesson ($R_t \cap W_l$), divided by the total number of responses which were incorrect on the lesson (W_l). This conditional probability was also calculated for high and low confidence correct responses on the lesson. Since the resulting conditional probability data were proportional data, they had to be transformed by using the arc sine function (Dowdy & Wearden, 1983). To test for statistical difference between the feedback conditions, a multivariate analysis of variance was performed on the transformed conditional probability data for each posttest.

Results

Overall Correct Responses

Table 1 shows the means and standard deviations for overall correct responses on the posttests. When the means on the immediate posttest were compared using a one-way analysis of variance, a statistical significant difference was found between the feedback conditions, $F(1,118) = 17.81$, $p < .001$, with those who receiving feedback performing significantly better than the no feedback group. When the means on the

delayed posttest were compared, no significant difference was found between the feedback conditions, $F(1,101) = 1.70$, $p = .19$.

In order to determine if there were significant differences between the feedback conditions regarding the performance on lesson, a one-way analysis of variance was calculated on the mean of three variables: number of correct responses on the lesson, text reading time, and response time. No significant differences were found on the analyses of the number of correct response and the response time. A significant difference was found between the feedback conditions with respect to the variable text reading time. The no feedback group spent significantly more time reading text frame than the feedback group, $F(1,118) = 9.91$, $p < .01$.

Table 1
Means and Standard Deviations for Correct Responses on Posttests

Test Position	Feedback Condition	
	Absent	Present
Immediate		
M	22.08	24.97
SD	4.34	3.02
Delay		
M	19.50	20.48
SD	4.89	5.11

Conditional Probability Measures

From the multivariate analysis of variance (MANOVA) performed on the means of the six transformed conditional probabilities on the immediate posttest, a significant difference was found between the feedback conditions (Wilks' lambda = .39321, F = 22.37550, Sig. of F < .001). Table 2 presents the univariate F-tests on the conditional probabilities.

Table 2
Analysis of Conditional Probability Measures on the Immediate Posttest

Variable	Group	N	Mean	Transformed Mean	SD	F	Sig. of F
$P(R_t \mid R_1)$	NFB	46	0.83	1.01	0.22	1.56	0.22
	FB	48	0.85	1.07	0.23		
$P(R_t \mid RH_1)$	NFB	46	0.86	1.10	0.25	0.00	0.99
	FB	48	0.87	1.10	0.22		
$P(R_t \mid RL_1)$	NFB	46	0.72	0.93	0.46	1.85	0.18
	FB	48	0.79	1.06	0.45		
$P(R_t \mid W_1)$	NFB	46	0.25	0.25	0.18	130.24	0.00
	FB	48	0.74	0.90	0.34		
$P(R_t \mid WH_1)$	NFB	46	0.22	0.26	0.36	79.16	0.00
	FB	48	0.77	1.05	0.49		
$P(R_t \mid WL_1)$	NFB	46	0.25	0.29	0.36	49.47	0.00
	FB	48	0.70	0.90	0.47		

The result of MANOVA performed on the means of the six transformed conditional probabilities on the delayed posttest also indicated a significant difference between the feedback conditions (Wilks' lambda = .62392, F= 7.43408, Sig. of F < .001). The results of the univariate F-tests were presented in Table 3.

Table 3
Analysis of Conditional Probability Measures on the Delayed Posttest

Variable	Group	N	Mean	Transformed Mean	SD	F	Sig. of F
$P(R_t \mid R_1)$	NFB	40	0.68	0.77	0.19	0.01	0.94
	FB	41	0.68	0.77	0.19		
$P(R_t \mid RH_1)$	NFB	40	0.71	0.82	0.24	0.65	0.42
	FB	41	0.69	0.78	0.21		
$P(R_t \mid RL_1)$	NFB	40	0.60	0.72	0.42	0.09	0.77
	FB	41	0.62	0.75	0.43		
$P(R_t \mid W_1)$	NFB	40	0.34	0.35	0.20	40.58	0.00
	FB	41	0.60	0.67	0.25		
$P(R_t \mid WH_1)$	NFB	40	0.39	0.48	0.47	9.88	0.00
	FB	41	0.64	0.80	0.46		
$P(R_t \mid WL_1)$	NFB	40	0.26	0.28	0.27	18.89	0.00
	FB	41	0.53	0.64	0.45		

The results regarding the probability of correct response on the test given that a correct response was made on the lesson, $P(R_t|R_1)$ on both the immediate and delayed posttests indicated no significant difference between the feedback conditions. When the correct responses on the both posttests were analyzed further on the basis of learner's confidence in the response made on the lesson, no significant differences were found between the groups concerning the probability of correct response on the test given that a correct response with high confidence was made on the lesson, $P(R_t|RH_1)$. The same results were found on both posttests for the probability of correct response on the test given that a correct response with low confidence was made on the lesson, $P(R_t|RL_1)$.

The results on both immediate and delayed posttests indicated that there was a significant difference between the no feedback and feedback groups ($p < .001$) regarding the probability of correct response on the test given that an incorrect response was made on the lesson, $P(R_t|W_1)$. When the correct responses on the test were analyzed further on the basis of learner's confidence in the response made on the lesson, it was found that there was significant difference between the two groups ($p < .001$) regarding the probability of correct response on the test given that a high confidence incorrect response was made on the lesson, $P(R_t|WH_1)$. For the probability of correct response on the test given that a low confidence incorrect response was made on the lesson, $P(R_t|WL_1)$, a significant difference was also found between the feedback and no feedback group ($p < .001$).

Discussion

Overall Correct Responses on Posttests

With respect to the overall correct responses on the immediate posttest, the feedback group performed significantly better than the no feedback group. However, no significant difference was found on the delayed posttest. The findings indicate that feedback helps to promote the subject's retention of learned material at least on the immediate retention.

The overall correct responses, then, were analyzed further to examine how feedback helps to increase the correct responses on the posttest by focusing on the effects of feedback following correct and incorrect responses on the lesson.

Feedback Following Correct Responses

It was hypothesized that providing feedback after correct responses would confirm the subjects that their understanding of the material was accurate and thus ensure that the same correct responses would be made on a later test. The analyses on both immediate and delayed posttests regarding the conditional probability of a correct response on the immediate posttest given that a correct response was made on the lesson did not support the above hypothesis. This result is similar to the result found in Guthrie's study (1971). Guthrie also found that providing feedback after a correct response did not increase the probability that the correct response would also be correct on a later test. However, a contradicting result was found in the study conducted by Kulhavy et al. (1976). In their study, it was found that the subjects who received feedback after a correct response were more likely to remember their correct responses on a subsequent test.

When the level of learner's confidence in the response was taken into account, the results of the present study indicate that knowledge of results (KOR) feedback provided for a high-confidence correct response on the lesson does not increase the probability that the answer would be correct again on the posttests. The findings also contradict the findings in the study by Kulhavy et al. (1976). For a low-confidence correct response, it was hypothesized that the positive response-contingent feedback (a statement of why the response is correct) in addition to KOR would help the acquisition of material, increase their confidence, and thus promote the retention of the learned material. The results of the study also fail to support this hypothesis.

The findings of the study regarding the effects of feedback following correct responses indicate that regardless of confidence in the response feedback does not help to increase the probability that a correct response will also be correct on a later test. One possible explanation for the results is probably due to attention effect. Attention plays an important role in learning from written materials (Anderson, 1970). It was found in this present study that the subjects in the no feedback group spent significantly more time reading text frame than those in the feedback group. Since the subjects in the no feedback did not receive additional help from feedback, they probably spent more time and effort in order to comprehend the material before they turned to the question. Research about the effect of comprehension depth and memory suggests that deeper comprehension of material is associated with better retention (Mistler-Lachman, 1974). The increased attention in the no feedback group probably attributed to the lack of significant effects of feedback following the correct response.

Feedback Following Incorrect Responses

It was hypothesized that feedback following incorrect responses would serve to correct error and ensure that a correct response would be made again on a later test. A significant difference was found between the feedback conditions regarding the conditional probability of a correct response on the each posttest given that an incorrect response was made in the lesson. Therefore, these findings support the hypothesis that feedback following incorrect responses increases the probability that the response will be correct on a later test. Similar results were also found in the study conducted by Guthrie (1971). In the study by Kulhavy et al. (1976), however, no significant difference was found between the feedback and no feedback group with respect to this conditional probability. The difference in the procedure between this present study and Kulhavy's study may account for the difference in the results. In Kulhavy's study, the subjects received knowledge of correct response (KCR) feedback and they could refer back to the text to locate their error. In the present study, the subjects received not only the KCR but also an explanation of why the response was not correct.

When the level of learner's confidence in the response was taken into account, a significant difference was found between the feedback and no feedback group regarding the conditional probability of a correct response on each posttest given that a high-confidence incorrect response was made on the lesson. The results indicated that feedback following a high-confidence incorrect responses helps the subject to correct errors. Similar results were also found in the study conducted by Kulhavy et al. (1976). With respect to the conditional probability of a correct response on the test given that a low-confidence incorrect response was made in the lesson, a significant difference was also found between the feedback and no feedback groups. Therefore, feedback following a low-confidence incorrect response also helps to correct error. However, no

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significant difference was found in the study conducted by Kulhavy et al. (1976). Again the difference between the results of their study and the present study is probably due to the differences in the procedure of the two studies. Another possible explanation might be the difference in the rating scale of learner's confidence in the response. In Kulhavy's study, the subjects rated their confidence on a scale of 5. In this present study, the subjects recorded their confidence either high or low.

Overall, the findings of the study suggest that feedback helps to promote immediate retention of verbal information. Regardless of the learner's confidence in the response, feedback following an incorrect response had significant effects on both immediate and delayed retention of the learned material. With respect to the function of feedback, the findings of this study seem to be consistent with previous feedback research which indicate that feedback functions as a guide for identifying and correcting error.

There are several recommendations for future research suggested by the finding of this study. First, it will be interesting to see whether the results will be replicated in similar studies conducted in the conditions as closely as possible to the actual classroom setting.

Other suggestions for further research, with respect to the experimental design, include a replication of this study which might include larger sample size in order to incorporate more treatment groups in the experimental design. For example, the design of this present study can be extended to include two more feedback groups: a group that will receive only Knowledge of Results (KOR) feedback regardless of the correctness of response or learner's confidence, and another group that will receive feedback which explains why an answer is correct or incorrect. Such a design would be appropriate in determining whether the provision of feedback information on the basis of correctness of response and learner's confidence is better than simply providing the same type of feedback to learners. Another variation in terms of the design might be to examine whether offering a chance for the learner to review the material after incorrect response and correct the mistake by himself will be as effective as providing feedback explaining why his answer is incorrect.

With respect to data analysis, it is recommended that research in the area of instructional feedback should include the conditional probability measure in the analysis. The use of such measure allows the researchers to examine the effects of feedback following correct and incorrect response separately.

Finally, future research is needed to examine the effects of feedback on retention across different types of learning outcomes. The learner's need of feedback information for one type of learning outcome may not be the same for another. The intended learning outcome emphasized in this study was verbal information. Future research might focus on the effects of feedback, correctness of response, and learner's confidence on retention of other types of learning outcomes such as intellectual skills and cognitive strategies as designated by Gagne (1977).

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